USDA Forest Service, Alaska Region
DESIGNATION ORDER
for the
Kenai Lake-Black Mountain Research Natural Area
on the
Chugach National Forest
Seward Ranger District, Alaska

Background:
In September 2000, the Forest Supervisor recommended establishment of four new Research Natural Areas (RNAs) in his Preferred Alternative for the Revised Land and Resource Management Plan of the Chugach National Forest. The Record of Decision for the Revised Forest Plan, [which I] signed in May 2002, documented the decision to follow the Forest Supervisor's recommendation to designate four Research Natural Areas on the Forest.

Among these is the Kenai Lake-Black Mountain RNA north of Seward, Alaska. That decision was the result of an analysis of the factors listed in 36 CFR 219.25 and Forest Service Manual 4063.41. Results of that analysis are documented in the Revised Land and Resource Management Plan for the Chugach National Forest, the Final Environmental Impact Statement for the Chugach National Forest Land Management Plan Revision, and the Establishment Record for the Kenai Lake-Black Mountain RNA. All of these documents are available to the public from the Chugach National Forest, 3301 "C" Street, Suite 300, Anchorage, AK 99503-3998. The Forest Plan documents are also available on the internet at: http://www.fs.fed.us/r10/chugach/forest_plan/plan_docs1.html

Designation:
Accordingly, by virtue of the authority delegated to me by the Chief of the Forest Service in Forest Service Manual 4063, and under regulations at 7 CFR 2.42, 36 CFR 251.23, and 36 CFR Part 219, I hereby establish the Kenai Lake-Black Mountain Research Natural Area. It shall be comprised of 5,829 acres (2,359 hectares) of land on the Seward Ranger District of the Chugach National Forest, Alaska. The Kenai Lake-Black Mountain RNA shall include part or all of T3N R1W Sections 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 22, 23 and T4N R1W Sections 34, 35, 36 on the U.S. Geological Survey 1:63,360 scale topographic map for the Seward B-7 quadrangle, Alaska, as described in the section of the Establishment Record entitled "Legal Description."

This is an administrative step to implement the decision to designate this area as RNA as discussed in the Record of Decision for the Revised Land and Resource Management Plan.

The Kenai Lake-Black Mountain RNA will be managed in compliance with all relevant laws, regulations, and Forest Service Manual direction regarding RNA's, and in accordance with the management direction identified in the Revised Forest Plan.

Designated by /s/ Dennis E. Bschor 8/22/07
DENNIS E. BSCHOR Date
Regional Forester, Alaska Region

Concurrence of /s/ Bov B. Eav 8/6/07
DR. BOV B. EAV Date
Station Director, Pacific NW Research Station

SIGNATURE PAGE
for

RESEARCH NATURAL AREA ESTABLISHMENT RECORD

Kenai Lake-Black Mountain Research Natural Area

Chugach National Forest

Alaska

The undersigned certify that all applicable land management planning and environmental analysis requirements have been met and that boundaries are clearly identified in accordance with FSM 4063.21, Mapping and Recordation and FSM 4063.41, Establishment Record Content, in arriving at this recommendation.

Prepared by /s/ Robert L. DeVelice Date 7/12/07
Robert L. DeVelice, Forest Ecologist, Chugach National Forest, with contributions by Judy Sherburne, formerly of Alaska Natural Heritage Program, University of Alaska.

Recommended by /s/ Jeni Evans Date 8/1/07
Jeni Evans, District Ranger, Seward District

Recommended by /s/ Joe L. Meade Date 8/1/07
Joe L. Meade, Forest Supervisor, Chugach National Forest

Concurrence of /s/ Bov B. Eav Date 8/6/07
Dr. Bov B. Eav, Station Director, Pacific Northwest Station

Establishment Record for the

Kenai Lake-Black Mountain
Research Natural Area within the

Chugach National Forest, Alaska

July 12, 2007

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IDENTIFICATION

Location Map

Kenai Lake-Black Mountain RNA is located on the Kenai Peninsula in southcentral Alaska on the Seward Ranger District of the Chugach National Forest (Figure 1). The RNA is about 15 miles (25 kilometers) due north of the city of Seward. No roads or established trails exist on the RNA or to its boundary. The closest road is the Seward Highway at the Kenai Lake Work Center (shown in Figure 1 as "Lawing" and in Figure 2 as "Kenai Work Center"). The Work Center is approximately 1 mile northeast of the RNA (across Kenai Lake) and is perhaps the best access point (via boat) to the RNA. Further details in regard to access to the RNA are described in the section of the Establishment Record entitled "Access".

Boundary Map[1]

The location of Kenai Lake-Black Mountain RNA within the public land survey system is shown in Figure 2.

Legal Description[1]

An area within the Chugach National Forest, comprising portions of T. 3-4 N., R. 1 W., Seward Meridian as shown on the attached map (Figure 2) entitled "Kenai Lake – Black Mountain RNA", said map being made herewith a part of this description, and said area being more particularly bounded and described as follows:

Beginning at a point on the south shore of Kenai Lake, said point being the intersection of the west bank of Meadow Creek with the ordinary high water line of Kenai Lake in Section 34, T. 4 N., R. 1 W., SM (position approximately 60º 23' 45" N; 149º 25' 51" W); thence Southwesterly along the west bank of Meadow Creek to a point 200 ft. from the ordinary high water line of Kenai Lake, said point being the true point of beginning and designated 'A' on the referenced map; thence easterly along a line 200 feet from and parallel with the ordinary high water line of Kenai Lake to the sixteenth section line common with the SW ¼, NE ¼ and the SE ¼, NE ¼, Section 34, T. 4 N., R. 1 W., SM. and designated 'B' on the referenced map; thence North approx. 200 feet along the aforesaid sixteenth section line to the ordinary high water line of Kenai Lake and designated 'C' on the referenced map; thence easterly and southerly along the ordinary high water line in Sections 34, 35 and 36, T. 4 N., R. 1 W., SM and Sections 1 and 12, T. 3 N., R. 1 W., SM to the quarter section line common with the NW ¼ and the SW ¼, Section 12, T. 3 N., R. 1 W., SM and designated 'D' on the referenced map; thence west approx. 2630 feet along aforesaid quarter section line through Sections 12 and 11, T. 3 N., R. 1 W., SM to the crest of a ridge, said ridge being the watershed divide between Meadow Creek drainage and Falls Creek drainage and designated 'E' on the referenced map; thence Southwesterly along the watershed divide through Sections 11, 14 and 23, T. 3 N., R. 1 W., SM to the North 1/16 corner common to Sections 22 and 23, T. 3 N., R. 1 W., SM and designated 'F' on the referenced map; thence Northwesterly along the watershed divide between Meadow Creek drainage and Falls Creek drainage and between Meadow Creek drainage and Ship Creek drainage

[1] Prepared by Randy D. Schrank, Professional Land Surveyor, Chugach NF, Anchorage, AK.

through Sections 22, 15 and 16, T. 3 N., R. 1 W., SM to Mount Adair Peak, said peak designated ‘G’ on the referenced map; thence westerly, northerly and easterly along the watershed divide between Meadow Creek drainage and Ship Creek drainage through Sections 16, 17, 8, 5 and 4, T. 3 N., R. 1 W., SM, said watershed divide passing through the peaks of Sleeping Sister Mountain to the Center East 1/16 corner in Section 4, T. 3 N., R. 1 W., SM and designated ‘H’ on the referenced map; thence North approx. 1320 feet to the Northeast 1/16 corner in Section 4, T. 3 N., R. 1 W., SM, and designated ‘I’ on the referenced map; thence East approx. 3550 feet through Sections 4 and 3, T. 3 N., R. 1 W., SM to the west bank of Meadow Creek, and designated ‘J’ on the referenced map; thence Northerly along the west bank of Meadow Creek in Section 3, T. 3 N., R. 1 W., SM and Section 34, T. 4 N., R. 1 W., SM to a point 200 feet from the ordinary high water line of Kenai Lake and the Point of Beginning, said Point of Beginning designated ‘A’ on the referenced map.

The area of this RNA comprises approximately 5830 acres.

Informational distances, geographic position and references to PLSS locations herein above were obtained by measurements and observations of the above referenced map being a portion of the US Forest Service 1994 Single Edition Quadrangle Seward (B-7), Alaska Map at a scale of 1:63,360 in original. Reference Datum is NAD-83.

End of Description

INTRODUCTION

The Kenai Lake-Black Mountain Research Natural Area (RNA) is located on the Seward Ranger District of the Chugach National Forest in southcentral Alaska (Figures 1 and 2; Photo 1). The RNA supports a wide diversity of vegetation types representative of the mountainous interior of the Kenai Peninsula. All of the lands in the RNA are under federal ownership, and total 5,829 acres (2,359 hectares). None of the RNA is designated wilderness or wild/scenic river. Primary human uses of the area have been selective tree harvesting (mostly in the early 1900's) on the lower slopes of Black Mountain and hunting and camping primarily along the Meadow Creek drainage.

The area has been under consideration for RNA designation since the mid 1960's (Juday 1981). Of particular ecological and evolutionary interest are the extensive occurrences of hybrids between Sitka spruce (*Picea sitchensis*)[2] and white spruce (*P. glauca*) on all aspects and exposures of the conical Black Mountain (the centerpiece of the RNA). The area includes shoreline landforms along Kenai Lake. Additionally, remnant alpine glaciers (Photo 2) and a wide range of shrubland and herbaceous vegetation types are present in the upper portions of the Meadow Creek drainage (Photo 3).

Presently, spruce trees in southcentral Alaska are experiencing extensive mortality in response to the spruce bark beetle (*Dendroctonus rufipennis*) and this is resulting in significant vegetation compositional and structural changes (Holsten et al. 1995). Perhaps the most significant alteration of vegetation composition within the Kenai Lake-Black Mountain RNA over the last 200+ years is the spruce mortality being caused by the spruce bark beetle.

JUSTIFICATION

Justification Statement

Within a compact area, the Kenai Lake-Black Mountain RNA contains a diversity of forest, scrubland, and herbaceous vegetation types across a wide spectrum of moisture, temperature, solar radiation, and disturbance conditions. The area contains representations of many of the vegetation types and biophysical combinations present within the mountainous interior portion of the Kenai Peninsula. The area offers excellent opportunities for effective extrapolation of research results from the RNA to the broader ecological region.

Principle Distinguishing Features

Among the elements of natural diversity represented in the Kenai Lake-Black Mountain RNA are vegetation communities dominated by *Picea sitchensis* x *P. glauca* hybrids (i.e., *P. x lutzii*[3]); *Tsuga mertensiana* high elevation forests (Photo 4); a diversity of shrublands including those dominated by *Luetkea pectinata*, *Cassiope stellariana*,

[2] Botanical nomenclature follows Hultén (1968) except where noted.
[3] Viereck and Little (1972).

Empetrum nigrum, *Vaccinium uliginosum*, *Salix alaxensis*, and *Alnus crispa* ssp. *sinuata*; and herbaceous communities including those dominated by *Calamagrostis canadensis* and *Epilobium angustifolium*. Landforms present include the conical Black Mountain, the shoreline of a major valley morainal lake (Kenai Lake), alpine areas with remnant glaciers, and areas undergoing active frost wedging and sorting of stony material and debris.

More detailed information on the biophysical characteristics of the area is provided in the "Ecological Evaluation" section of this establishment record.

Objectives

The objectives of Kenai Lake-Black Mountain RNA are to:

1. Maintain and conserve (in a natural state) a representative range of Sitka spruce-white spruce hybrid (hereafter referred to as Lutz spruce) dominated forests and the diversity of vegetation types present;
2. Provide a reference area for the study of both short- and long-term ecological change (such as forest successional responses following bark beetle induced tree mortality); and,
3. Provide a reference area for determining the effects of resource management activities applied to similar ecosystems outside the RNA.

LAND MANAGEMENT PLANNING

In 1984, the Kenai Lake-Black Mountain area was proposed as RNA in the first Land and Resource Management Plan of the Chugach National Forest (USDA Forest Service 1984). In 2002, the area was designated as RNA in the Record of Decision for the Revised Forest Plan (USDA Forest Service 2002a). That selection was the result of analyses documented in the Revised Forest Plan (USDA Forest Service 2002b) and the Final Environmental Impact Statement for the Revised Forest Plan (USDA Forest Service 2002c). No major issues or conflicts specific to the Kenai Lake-Black Mountain area were identified during the public review and comment period for the draft plan.

MANAGEMENT PRESCRIPTION

The Forest Plan (USDA Forest Service 2002b) prescription for Research Natural Areas is included in the Appendix of this establishment record. RNA management emphasizes non-manipulative research, monitoring, education, and the maintenance of natural diversity. Natural ecological processes dominate, largely undisturbed by human activity. Management for recreation uses, habitat improvement or restoration, and resource development are not emphasized. Recreation uses that interfere with the purpose of the RNA may be restricted. Any proposed action within the RNA must be coordinated with USDA Forest Service Pacific Northwest Research Station.

No measures for control of native insects or diseases will be undertaken unless forests on adjacent lands are threatened. If non-native (exotic) invasive plants or animals are found in the RNA control measures will be exercised to eradicate them, when practical.

USE OR CONTROL OF FIRE AND GRAZING

No prescribed fires are planned, but may be used as necessary to accomplish RNA objectives. Since the natural fire return interval of the area likely exceeds 500 years (Potkin 1997), it is unlikely that prescribed burning is necessary in the near future to maintain the fire return cycle.

In regard to fire control, most of the forested portion of the RNA is mapped within the full fire suppression protection level[4]. Under this protection level the suppression objective is to control the fire at the smallest acreage reasonably possible. Within the RNA, the fire control methods used would be those causing the least disturbance.

No grazing by domestic livestock is planned nor is there an existing or anticipated need for such grazing to maintain or restore ecological conditions.

ECOLOGICAL EVALUATION

Physical Site Description and Climatic Conditions

Location

Kenai Lake-Black Mountain RNA is within the Seward Ranger District of the Chugach National Forest. The center of RNA is approximately at 60° 23 minutes north and 149° 26 minutes west (Figures 1 and 2).

Size

Kenai Lake-Black Mountain RNA is 5,829 acres (2,359 hectares) in size.

Elevation Range

Elevations within Kenai Lake-Black Mountain range from 440 to 5,180 feet (135 to 1,580 m).

Access

Access to Kenai Lake-Black Mountain RNA is by boat, aircraft, or foot. No roads or established trails exist on the RNA or to its boundary (Figure 2). The closest road is the Seward Highway at the Kenai Lake Work Center (shown in Figure 1 as “Lawing” and in Figure 2 as “Kenai Work Center”). The Work Center is approximately 1 mile (1.6 km) northeast of the RNA and is perhaps the best access point (via boat) to the RNA. The lake crossing is potentially dangerous, particularly in high winds. The lake waters are frigid. Via the Seward Highway,

[4] http://www.dnr.state.ak.us/forestry/fire/fireplans.htm

Kenai Lake Work Center is approximately 60 miles (97 km) from Anchorage and 21 miles (34 km) from Seward.

The shortest access by foot is via bushwhack from Primrose Campground (shown on the lower right corner of Figure 2 as "Primrose Landing") approximately 1.5 miles (2.4 km) due south of the RNA boundary. This approach requires fording Primrose Creek (immediately north of the campground). This ford is potentially dangerous and may be impossible at high flows.

Another option for accessing the RNA is by floatplane or helicopter. Aircraft operations on the Chugach National Forest are regularly restricted by storms, heavy precipitation, high winds, and limited visibility because of fog and low clouds. During colder months supercooled water droplets in the atmosphere can cause dangerous wing icing conditions, and the short days of this high latitude location restrict daytime activities. Visitors arriving by boat or aircraft cannot plan on adhering to a schedule and must be prepared to arrive or depart as circumstances dictate.

Climatic Data

The Kenai Lake-Black Mountain RNA and vicinity sits in a relative rain shadow of mountains to the south and southeast. As an indication of this relative dryness, the interior of the Kenai Peninsula is the only portion of the Chugach National Forest in which natural fires occur (Potkin 1997). However, atmospheric conditions rarely favor development of powerful convective storms and lighting occurrence is rare. The natural fire return interval is estimated to exceed 500 years (Potkin 1997).

The nearest weather station to the RNA is Moose Pass 3 NW at approximately 60° 30 minutes north and 149° 26 minutes west. This climate station is about 6 miles (10 km) north northeast of the RNA at 485 feet (148 m) elevation. Records from this station (Table 1) are likely representative of the lower elevations of the RNA. Mean temperature and precipitation isohyte maps presented by Blanchet (1983) suggest that, depending on elevation, mean annual temperature varies from 24 to 35°F (-4.4 to 1.7° C) and mean annual precipitation from 30 to 70 inches (76 to 178 cm) within the RNA.

The climate of the Kenai Lake-Black Mountain RNA and vicinity can be further described as transitional, with both maritime and continental influences. For example, the mean monthly temperatures in January are near 16°F (-9° C), which is suggestive of cold continental conditions, while the mean temperature of July is around 57°F (14° C), suggesting the moderating influence of the ocean on climate (Table 1). The transitional nature of the climate is reflected in the vegetation. The area supports species with both coastal and interior affinities. For example, populations of Lutz spruce, a natural hybrid between Sitka spruce (typical of coastal forests from Oregon to Kodiak Island) and white spruce (typical of boreal forests across Canada and interior Alaska), occur in the area.

Table 1 – Climate records for Moose Pass 3 NW, Alaska[5].

	Mean Temperature		Record High Temperature		Mean Precipitation	
	°F	°C	°F	°C	inches	cm
January	16.2	-8.8	47	8.3	2.24	5.69
February	18.9	-7.3	50	10.0	2.21	5.61
March	26.2	-3.2	58	14.4	0.99	2.51
April	35.9	2.2	65	18.3	0.94	2.39
May	44.2	6.8	80	26.7	1.38	3.51
June	52.2	11.2	87	30.6	0.88	2.24
July	56.7	13.7	89	31.7	1.53	3.89
August	54.9	12.7	85	29.4	3.03	7.70
September	46.9	8.3	73	22.8	4.9	12.45
October	34.5	1.4	60	15.6	3.79	9.63
November	24.1	-4.4	53	11.7	3.21	8.15
December	19.3	-7.1	50	10.0	2.8	7.11
Mean Annual	35.8	2.1			27.90	70.87
Mean May-September	51.0	10.5			11.7	29.77
Mean October-April	25.0	-3.9			16.2	41.10
Maximum date			89 07/04/99	31.7		
Minimum date			-43 01/15/73	-41.7		

[5] Data obtained from the Alaska Climate Research Center (http://climate.gi.alaska.edu/). Mean temperature and mean precipitation records are from the 1971 through 2000 period. Record high temperature, maximum, and minumum records are from the period 1952 through 2004.

Ecological Description

Eco-region

Within the ECOMAP (1993) hierarchy, the entire Kenai Lake-Black Mountain RNA occurs within the Humid Temperate Domain, Marine Division (Bailey 1995; Davidson 1996)[6]. The Mount Adair and Sleeping Sister Mountain portion of the RNA is in the Pacific Coastal Mountains Forest-Meadow Province, Chugach Mountains Section, Eastern Kenai Mountains Subsection (Davidson 1996). The Black Mountain portion of the RNA is in the Pacific Gulf Coastal Forest-Meadow Province, Northern Gulf Fjordlands Section, Kenai Fjordlands Subsection (Davidson 1996).

Landtype association and landtype (ECOMAP 1993; Davidson 1998) mapping of the area identifies the following three associations and associated landtypes in the RNA (see Table 2 and Figure 3):

10 Mountain Summits

This association covers about 36 percent of the RNA and includes mountaintops, ridges, and upper rocky portions of Sleeping Sister Mountain and Mount Adair. Extreme climatic influences have resulted in the weathering and fracturing of bedrock by frost action. Remnant glaciers are found in this association on the northerly slopes of Mount Adair. Rock outcrops and coarse textured soil dominate the surface.

30 Mountain Sideslopes

This association covers about 25 percent of the RNA and forms the generally steep westerly, northerly, and easterly forested slopes of Black Mountain. The dominant physical process is transport of water downslope. Soil and rock material is also transported from erosion and mass wasting. Avalanches and landslides (as visible on the northeast slope of Black Mountain) are common within this association.

90 Hills

Covering about 39 percent of the RNA, this association occurs on the upper, summit portions of Black Mountain. It is characterized by low to moderate relief. The dominant physical process is erosion and sediment transport by water. Low areas collect runoff due to lack of out flow.

Plant Community Types

Landcover types of the Kenai Lake-Black Mountain RNA are shown in Figure 4 as mapped by Markon and Williams (1996) using the Alaska Vegetation Classification (Viereck et al. 1992). Table 3 summarizes the acreage for these types and a cross-walk to the National Vegetation Classification System (Federal Geographic Data Committee 1997).

[6] Based on data from the "Ecosections and Sub-Sections" data theme of the Chugach National Forest GIS.

Table 2 – Landtype associations and landtypes of Kenai Lake-Black Mountain RNA[7].

Landtype Association	Landtype	Acres	Hectares	Percent
10	GLCR	114	46	2.0
10	MTROU	554	224	9.5
10	MTRUG	1404	568	24.1
	LTA 10 Total	**2072**	**839**	**35.6**
30	ALFA	37	15	0.6
30	MSDI	600	243	10.3
30	MSND	739	299	12.7
30	RAVI	86	35	1.5
	LTA 30 Total	**1462**	**592**	**25.1**
90	HIHR	2295	929	39.4
CW	CLWA	0.01	0.01	0.00
	GRAND TOTAL	**5829**	**2359**	**100**

[7] Data from the "Landsystem Types" data theme of the Chugach National Forest GIS. Landtype Association 10 = mountain summits; 30 = mountain sideslopes; 90 = hills; and CW = clear water. Landtype ALFA = alluvial vans; CLWA = clear water; GLCR = glacier; HIHR = hills - high relief; MSDI = mountain sideslopes - disturbed; MSND = mountain sideslopes - non disturbed; MTROU = mountains - rounded; MTRUG = mountains - rugged; and RAVI = ravines.

Table 3 – Landcover classes of Kenai Lake-Black Mountain RNA[8].

Value	Landcover Class	NVCS[9]	Acres	Hectares	Percent	Subtotal Percents
1	Closed Needleleaf Forest	I.A.8.N.c	2168	877	37	
2	Open Needleleaf Forest	II.A.4.N.b	8	3	0	
3	Woodland Needleleaf Forest	II.A.4.N.b	89	36	2	forest
4	Closed Broadleaf Forest	I.B.2.N.c	301	122	5	44
13	Closed Tall Shrub	III.B.2.N.b	722	292	12	
14	Open Tall Shrub	III.B.2.N.b	334	135	6	
15	Closed Low Shrub	III.A, III.B.2	216	87	4	shrub
16	Open Low Shrub	III.A, III.B.2	121	49	2	24
17	Dry/Mesic Graminoid/Forb	V.A.5.N, V.B.2.N	450	182	8	herbaceous
24	Lichen	VI.B.1.N.b	119	48	2	10
28	Clear Water	non-veg.	0	0	0	
29	Turbid Water	non-veg.	5	2	0	
33	Bedrock or Unconsolidated	non-veg.	159	65	3	
35	Sand/Mud	non-veg.	221	90	4	
36	Ice/Snow/Clouds	non-veg.	110	44	2	
38	Shadow	N/A	456	185	8	other
39	Sparsely Vegetated	VII	349	141	6	22
	GRAND TOTAL		**5829**	**2359**	**100**	**100**

[8] Data from the "Land Cover Classification" data theme of the Chugach National Forest GIS.
[9] National Vegetation Classification equivalent (Federal Geographic Data Committee 1997).

Vegetation types (DeVelice et al. 1999) known to occur in the Kenai Lake-Black Mountain RNA are listed in Table 4[10]. Acreage by vegetation type was estimated based on extrapolating from the landcover types and the field data.

Values

Flora

The flora of Kenai Lake-Black Mountain RNA has not been thoroughly collected, described, or studied. Table 5 lists the 178 plant taxa observed in Kenai Lake-Black Mountain RNA in field surveys of the area.

Fauna

Animal species have not been systematically studied or inventoried in the Kenai Lake-Black Mountain RNA. The following species were observed during field surveys or are predicted to occur within the Kenai Lake-Black Mountain RNA based on the literature:

Mammals

Table 6 is a list of 31 mammal species that occur or may occur in the Kenai Lake-Black Mountain Research Natural Area.

The historical distribution of the mountain goat (*Oreamnos americanus*) encompasses the high mountainous regions of southcentral Alaska to southcentral Washington. In southcentral Alaska, mountain goats are primarily located in the Chugach and Wrangell mountains. There are mountain goats in the Kenai Mountains, extending southwest of the Chugach Mountains. Of specific interest is a population that uses the Mount Adair region of the Kenai Lake-Black Mountain RNA.

Mountain goat populations are primarily stable or increasing throughout their range, in general. The Kenai Peninsula population is estimated at 4,000 - 5,000 animals. The reproductive productivity of most herds is low, with females producing a single kid (twinning is rare) and breeding may not always occur every year. Regardless, population numbers may be at a historical high on the Kenai Peninsula (Ted Spraker, Alaska Department of Fish and Game, *personal communication*).

Alaska Department of Fish and Game (ADF&G) transects are established in the region approximately bounded by the Resurrection River, Kenai Lake, Copper Mountain, and the Seward Highway (ADF&G Area 842). The area includes Mount Adair within the Kenai Lake-Black Mountain RNA. The 1991 area survey counted 96 goats (71 adults, 25 kids).

[10] 40 vegetation plots were sampled to document vegetation compositional variation. The data for these plots are on file with the Forest Ecologist, Chugach National Forest, Anchorage, Alaska.

Table 4 – Estimated extent of major vegetation types (DeVelice et al. 1999) in Kenai Lake-Black Mountain RNA. Acreages rounded to the nearest 5.

Vegetation Type	Acres	Hectares
Picea x lutzii/Echinopanax horridus	465	190
P. x lutzii/Alnus crispa ssp. *sinuata*	290	120
P. x lutzii/Dryopteris dilatata	175	70
Tsuga mertensiana/Menziesia ferruginea	290	120
T. mertensiana/M. ferruginea-Vaccinium vitis-idaea	175	70
T. mertensiana/M. ferruginea/sparse	115	45
T. mertensiana/Cassiope stellariana	60	25
T. mertensiana/Vaccinium vitis-idaea	60	25
T. mertensiana-P. x lutzii/M. ferruginea	585	235
T. mertensiana-P. x lutzii/M. ferr.-V. vitis-idaea	350	140
TOTAL FOREST	2565	1040
A. crispa ssp. *sinuata/D. dilatata*	330	135
A. crispa ssp. *sinuata/E. horridus*	155	65
Betula nana	10	5
C. stellariana-Luetkea pectinata	410	165
Empetrum nigrum-Arctostaphylos alpina	165	65
E. nigrum-Vaccinium uliginosum	165	65
E. nigrum	80	35
Myrica gale/Eriophorum angustifolium	10	5
Salix alaxensis	10	5
Salix reticulata/Festuca altaica	60	25
TOTAL SHRUB	1395	570
Calamagrostis canadensis	165	65
Carex aquatilis	20	10
Carex machrochaeta	70	30
Epilobium angustifolium	105	40
F. altaica/Geranium erianthum	105	40
Luzula wahlenbergii	105	40
TOTAL HERBACEOUS	570	225

Table 5 – Plants taxa observed in Kenai Lake-Black Mountain RNA[11].

Scientific Name	Common Name
TREES	
Betula papyrifera	paper birch
Picea x lutzii	Lutz spruce
Picea sitchensis	Sitka spruce
Populus balsamifera ssp. *trichocarpa*	balsam poplar
Tsuga mertensiana	mountain hemlock
TALLSHRUBS	
Alnus crispa ssp. *sinuata*	Sitka alder
*Betula nana*bog	birch
Echinopanax horridus	devilsclub
Menziesia ferruginea	rusty menziesia
Myrica gale	sweetgale
Potentilla fruticosa	shrubby cinquefoil
Ribes laxiflorum	trailing black currant
Ribes sp.	currant
Ribes triste	red currant
Rosa acicularis	prickly rose
Rubus spectabilis	salmonberry
Salix alaxensis	feltleaf willow
Salix sp.	willow
Sambucus racemosa	scarlet elderberry
Sorbus scopulina	Greene mountainash
Sorbus sitchensis	western mountainash
Vaccinium ovalifolium	ovalleaf blueberry
Viburnum edule	tallbush cranberry
DWARF OR SUBSHRUBS	
Andromeda polifolia	bog rosemary
Arctostaphylos alpina	alpine bearberry
Arctostaphylos uva-ursi	kinnikinnick

[11] Vascular plant nomenclature follows Hultén (1968) except for *P x lutzii* which follows Viereck and Little (1972). Moss and lichen nomenclature follows (Vitt et al. 1988). Common names follow the Chugach National Forest plant species list (*unpublished*, Anchorage, AK).

Table 5 – (continued)

Scientific Name	Common Name
Cassiope stelleriana	starry cassiope
Diapensia lapponica	pincushion plant
Dryas octopetala	white dryad
Empetrum nigrum	black crowberry
Juniperus communis	common juniper
Ledum palustre	marsh Labradortea
Linnaea borealis	twinflower
Loiseleuria procumbens	alpine azalea
Luetkea pectinata	partridgefoot
Salix arctica	Arctic willow
Salix reticulata	netleaf willow
Salix rotundifolia	least willow
Spiraea beauverdiana	Beauverd spirea
Vaccinium uliginosum	bog blueberry
Vaccinium vitis-idaea	lowbush cranberry
FORBS	
Achillea borealis	yarrow
Aconitum delphiniifolium	larkspurleaf monkshood
Anemone narcissiflora	narcissus anemone
Anemone parviflora	smallflowered anemone
Anemone richardsonii	yellow thimbleweed
Antennaria monocephala	pygmy pussytoes
Aquilegia formosa	western columbine
Arabis divaricarpa	spreadingpod rockcress
Arnica latifolia	broadleaf arnica
Artemisia arctica	boreal sagebrush
Artemisia tilesii	Tilesius' wormwood
Aruncus sylvester	goatsbeard
Aster sp.	aster
Caltha leptosepala	white marshmarigold
Campanula rotundifolia	bluebell bellflower
Castilleja unalaschcensis	Alaska Indian paintbrush
Cerastium sp.	chickweed
Cornus canadensis	bunchberry dogwood
Draba sp.	whitlowgrass
Drosera rotundifolia	roundleaf sundew

Table 5 – (continued)

Scientific Name	Common Name
Epilobium anagallidifolium	alpine willowherb
Epilobium angustifolium	fireweed
Epilobium latifolium	dwarf fireweed
Epilobium palustre	marsh willowherb
Epilobium sp.	willowweed
Erigeron peregrinus	subalpine fleabane
Fritillaria camschatcensis	Kamchatka missionbells
Galium boreale	northern bedstraw
Galium triflorum	fragrant bedstraw
Gentiana glauca	pale gentian
Gentiana propinqua	four-parted gentian
Gentiana sp.	gentian
Geranium erianthum	woolly geranium
Geum rossii	alpine avens
Hedysarum alpinum	alpine sweetvetch
Heracleum lanatum	cow parsnip
Hieracium gracile	slender hawkweed
Hieracium sp.	hawkweed
Lappula sp.	stickseed
Leptarrhena pyrolifolia	fireleaf leptarrhena
Lupinus nootkatensis	Nootka lupine
Minuartia arctica	Arctic stitchwort
Moneses uniflora	single delight
Myosotis alpestris	forget-me-not
Oxyria digyna	alpine mountainsorrel
Oxytropis campestris	cold mountain crazyweed
Pedicularis sp.	lousewort
Petasites hyperboreus	sweet coltsfoot
Polemonium acutiflorum	tall Jacobsladder
Polygonum viviparum	alpine bistort
Potentilla sp.	cinquefoil
Prenanthes alata	western rattlesnakeroot
Pyrola chlorantha	greenflowered wintergreen
Pyrola secunda	one-sided wintergreen
Rhinanthus minor	little yellowrattle
Rubus pedatus	strawberryleaf raspberry
Sanguisorba stipulata	Sitka burnet
Saxifraga bronchialis	yellowdot saxifrage

Table 5 – (continued)

Scientific Name	Common Name
Saxifraga punctata	heart-leaved saxifrage
Saxifraga tricuspidata	three toothed saxifrage
Sedum rosea	roseroot stonecrop
Senecio triangularis	arrowleaf groundsel
Sibbaldia procumbens	creeping sibbaldia
Solidago multiradiata	mountain goldenrod
Streptopus amplexifolius	claspleaf twistedstalk
Swertia perennis	star gentian
Trientalis europaea	Arctic starflower
Valeriana capitata	captiate valerian
Valeriana sitchensis	Sitka valerian
Veratrum viride	American false hellebore
Viola langsdorfii	Aleutian violet
Zigadenus elegans	mountain deathcamas
GRAMINOIDS	
Agropyron violaceum	violet wheatgrass
Agrostis borealis	northern bentgrass
Calamagrostis canadensis	bluejoint
Carex aquatilis	water sedge
Carex circinata	coiled sedge
Carex macrochaeta	longawn sedge
Carex michrochaeta	smallawned sedge
Carex microglochin	fewseeded bog sedge
Carex nesophila	nesophila sedge
Carex pluriflora	manyflower sedge
Carex sp.	sedge
Eriophorum angustifolium	tall cottongrass
Eriophorum scheuchzeri	white cottongrass
Festuca altaica	Altai fescue
Hierochloe alpina	alpine holy grass
Juncus mertensianus	Mertens' rush
Luzula multiflora	common woodrush
Luzula sp.	woodrush
Luzula wahlenbergii	Wahlenberg's woodrush
Phleum commutatum	mountain timothy
Poa sp.	Bluegrass

Table 5 – (continued)

Scientific Name	Common Name
Trichophorum caespitosum	tufted bulrush
Trisetum spicatum	spike trisetum
Vahlodea atropurpurea	mountain hairgrass
FERNS AND FERN ALLIES	
Botrychium lunaria	common moonwort
Cryptogramma crispa	crisp rockbrake
Dryopteris dilatata	wood fern
Equisetum arvense	field horsetail
Equisetum scirpoides	dwarf scouringrush
Gymnocarpium dryopteris	western oakfern
Lycopodium alpinum	alpine clubmoss
Lycopodium annotinum	stiff clubmoss
Lycopodium selago	fir clubmoss
Woodsia ilvensis	rusty woodsia
MOSSES	
Dicranum sp.	dicranum moss
Hylocomium splendens	splendid feather moss
Pleurozium schreberi	Schreber's big red stem moss
Polytrichum commune	polytrichum moss
Polytrichum sp.	polytrichum moss
Ptilium crista-castrensis	knights plume moss
Racomitrium sp.	racomitrium moss
Rhizomnium sp.	rhizomnium moss
Rhytidiadelphus triquetrus	rough goose neck moss
Sphagnum fuscum	sphagnum
Sphagnum girgensohnii	Girgensohn's sphagnum
Sphagnum sp.	sphagnum
LICHENS	
Cetraria islandica	island cetraria lichen
Cetraria nivalis	cetraria lichen
Cetraria sp.	cetraria lichen
Cladina rangiferina	gray reindeer lichen

Table 5 – (continued)

Scientific Name	Common Name
Cladina sp.	reindeer lichen
Cladina stellaris	star reindeer lichen
Cladonia bellidiflora	cup lichen
Cladonia cornuta	cup lichen
Cladonia sp.	cup lichen
Cladonia squamosa	cup lichen
Nephroma arcticum	Arctic kidney lichen
Nephroma sp.	kidney lichen
Peltigera aphthosa	felt lichen
Peltigera sp.	felt lichen
Stereocaulon alpinum	alpine snow lichen
Stereocaulon sp.	snow lichen
Thamnolia sp.	whiteworm lichen
Thamnolia subuliformis	whiteworm lichen
Thamnolia vermicularis	whiteworm lichen

Table 6 – Mammals species observed or potentially occurring in Kenai Lake-Black Mountain RNA[12].

Scientific name	Common name	Comments
INSECTIVORA		
Sorex cinereus	masked shrew	b
Sorex monticolus	montane shrew	b
Microsorex hoyi	pygmy shrew	b n
CHIROPTERA		
Myotis lucifugus	little brown myotis	b
LAGOMORPHA		
Lepus americanus	snowshoe hare	a2
RODENTIA		
Marmota caligata	hoary marmot	b
Spermophilus parryii	Arctic ground squirrel	b n
Tamiasciurus hudsonicus	red squirrel	a1
Glaucomys sabrinus	flying squirrel	b
Castor canadensis	beaver	a5
Clethrionomys rutilus	northern red-backed vole	b
Microtus pennsylvanicus	meadow vole	b n
Microtus oeconomus	tundra vole	b
Microtus miurus	singing vole	b
Ondatra zibethicus	muskrat	b
Synaptomys borealis	northern bog lemming	b
Zapus hudsonius	meadow jumping mouse	b
Erethizon dorsatum	porcupine	a1

[12] Comment codes are defined as follows:
a = sign observed or sighting during field survey (1 = seen; 2 = scat; 3 = browse; 4 = diggings; 5 = activity);
b = distribution records from Hall and Kelson (1959), Manville and Young (1965), or Alaska Department of Fish and Game (1978), Alaska Department of Fish and Game *personal communication*, and/or U.S. Forest Service *personal communication*;
n = questionable distribution or on edge of distribution.

Table 6 – (continued)

Scientific name	Common name	Comments
CARNIVORA		
Canis latrans	coyote	b
Canis lupus	gray wolf	a2
Vulpes vulpes	red fox	b
Ursus americanus	black bear	a4
Ursus arctos	brown bear	b
Martes americana	marten	b
Mustela erminea	ermine	b
Mustela vison	mink	b
Gulo gulo	wolverine	b
Lutra canadensis	river otter	b
Felis lynx	lynx	b
ARTIODACTYLA		
Alces alces	moose	a23
Oreamnos americanus	mountain goat	a1

Mountain goats are both grazers and browsers, depending upon the habitat and season (Wigal and Coggins 1982). During spring, they prefer south-facing slopes and avalanche chutes, where there is the earliest spring growth of plant shoots (Schoen and Kirchhoff 1982). In the summer they are found mostly in subalpine and alpine meadows taking grasses, sedges, forbs, ferns, and low shrubs. During the winter, some migrate to lower elevations at or below treeline (Smith 1986). Others overwinter on ridges where the vegetation is exposed by the wind. During this time, they shift to browsing on hemlock, spruce, or shrubby vegetation, or, grazing on mosses and lichens (Fox and Smith 1988).

The proximity to escape terrain is a critical factor in evaluating mountain goat habitat. Goats move to steep, irregular terrain with drops and cliffs when approached by predators such as the gray wolf (Fox and Streveler 1986). Investigators have variously estimated the required near distance to escape terrain was 660-2600 feet (200-800 m; USDA Forest Service 1990). The right combination of escape terrain and forage strictly define mountain goat habitat.

Mountain goats are sensitive to changes in habitat and hunting pressure. Chadwick (1983) considers them the most sensitive of megafauna in North America. Years may pass for a herd to recover from losses due to overhunting, predation, or starvation. Winter is the most limiting time of the year, when snow reduces the availability of plants. The canopy of trees at lower elevations reduces snow depth and, theoretically, increases availability of forage species to mountain goats (Hanley and Rose 1987).

Birds

Table 7 is a list of 28 birds observed or heard in the Kenai Lake-Black Mountain RNA during the field survey for this establishment record or Seward District (USDA Forest Service) bird surveys. There was one unverified sighting of a green sandpiper, a very rare Eurasian species with only two verified sightings on Attu Island in the Aleutians.

There are a total of 119 birds that are or may occur within the RNA. Table 8 is a list of 91 additional species which are likely to occur there based on known bird distributions (Alaska Natural Heritage Program 1995) and appropriate habitats within the RNA.

There are two disjunct populations of harlequin ducks (*Histrionicus histrionicus*), the Pacific population and the Atlantic population. Both have experienced substantial declines, while the Pacific populations apparently stable in some areas and declining in others (Alaska Natural Heritage Program 1993). Generally, harlequins are more abundant in Alaska in than other parts of its North American range though local population

Table 7 – Bird species observed in Kenai Lake-Black Mountain RNA[13].

Scientific name	Common name	Comments
Histrionicus histrionicus	harlequin duck	a
Circus cyaneus	northern harrier	a
Dendragapus canadensis	spruce grouse	a
Lagopus spp.	ptarmigan	a
Tringa ocrophus	green sandpiper	a n
Actitis macularia	spotted sandpiper	a
Gallinago gallinago	common snipe	a
Picoides tridactylus	three-toed woodpecker	a, b
Tachycineta thalassina	violet-green swallow	a
Perisoreus canadensis	gray jay	a
Parus atricapillus	black-capped chickadee	a, b
Parus hudsonicus	boreal chickadee	a
Cinclus mexicanus	American dipper	a
Ixoreus naevius	varied thrush	a, b
Catharus guttatus	hermit thrush	a, b
Catharus ustulatus	Swainson's thrush	a, b
Regulus calendula	ruby-crowned kinglet	a, b
Regulus satrapa	golden-crowned kinglet	a
Lannius excubitor	northern shrike	a
Vermivora celata	orange-crowned warbler	a, b
Dendroica petechia	yellow warbler	b
Dendroica coronata	yellow-rumped warbler	a
Dendroica townsendi	Townsend's warbler	a, b
Passerculus sandwichensis	savannah sparrow	a
Junco hyemalis	dark-eyed junco	a, b
Carduelis flammea	common redpoll	b
Carduelis pinus	pine siskin	a, b
Loxia leucoptera	white-winged crossbill	b

[13] Nomenclature follows Armstrong (1980) and Roberson (1980). Comment codes are defined as follows:
a = identified by sight or call during field survey;
b = identified by sight or call during 1994 Seward Ranger District bird surveys;
n = not confirmed

Table 8 – Bird species potentially occurring in Kenai Lake-Black Mountain RNA in addition to those listed in Table 7[14].

Scientific name	Common name
Gavia immer	common loon
Gavia arctica	Arctic loon
Gavia stellata	red-throated loon
Podiceps grisegena	red-necked grebe
Podiceps auritus	horned grebe
Cygnus columbianus	tundra swan
Cygnus buccinator	trumpeter swan
Branta canadensis	Canada goose
Anser albifrons	greater white-front goose
Anas platyrhynchos	mallard
Anas strepera	gadwall
Anas acuta	northern pintail
Anas crecca	green-winged teal
Anas clypeata	northern shoveler
Anas americana	American widgeon
Aythya valisineria	canvasback
Aythya marila	greater scaup
Bucephala clangula	common goldeneye
Bucephala islandica	Barrow's goldeneye
Bucephala albeola	bufflehead
Mergus merganser	common merganser
Mergus serrator	red-breasted merganser
Accipiter gentilis	northern goshawk
Accipiter striatus	sharp-shinned hawk
Buteo jamaicensis	red-tailed hawk
Aquila chrysaetos	golden eagle
Haliaeetus leucocephalus	bald eagle
Falco columbarius	merlin
Falco peregrinus	peregrine falcon
Grus canadensis	sandhill crane
Charadrius semipalmatus	semipalmated plover
Tringa melanoleuca	greater yellowlegs
Tringa flavipes	lesser yellowlegs
Tringa solitaria	solitary sandpiper
Heteroscelus incanus	wandering tattler
Phalaropus lobatus	red-necked phalarope
Limnodromus griseus	short-billed dowitcher

[14] Nomenclature follows Armstrong (1980).

Table 8 – (continued)

Scientific name	Common name
Calidris mauri	western sandpiper
Calidris minutilla	least sandpiper
Larus argentatus	herring gull
Larus philadelphia	Bonaparte's gull
Larus canus	mew gull
Sterna paradisaea	arctic tern
Brachyramphus brevirostris	Kittlitz's murrelet
Bubo virginianus	great horned owl
Surnia ulula	northern hawk-owl
Satrix nebulosa	great gray owl
Asio flammeus	short-eared owl
Aegolius funereus	boreal owl
Aegolius acadicus	northern saw-whet owl
Selasphorus rufus	rufous hummingbird
Ceryle alcyon	belted kingfisher
Picoides villosus	hairy woodpecker
Picoides pubescens	downy woodpecker
Colaptes auratus	northern flicker
Sayornis saya	Say's phoebe
Empidonax alnorum	alder flycatcher
Contopus sordidulus	western wood-pewee
Contopus borealis	olive-sided flycatcher
Tachycineta bicolor	tree swallow
Riparia riparia	bank swallow
Hirundo pyrrhonota	cliff swallow
Hirundo rustica	barn swallow
Cyanocitta stelleri	Steller's jay
Pica pica	black-billed magpie
Corvus caurinus	northwestern crow
Corvus corax	common raven
Parus rufescens	chestnut-backed chickadee
Sitta canadensis	red-breasted nuthatch
Certhia americana	brown creeper
Troglodytes troglodytes	winter wren
Turdus migratorius	American robin
Catharus minimus	gray-cheeked thrush
Anthus spinoletta	American pipit
Bombycilla garrulus	Bohemian waxwing
Dendroica striata	blackpoll warbler

Table 8 – (continued)

Scientific name	Common name
Seiurus noveboracensis	northern waterthrush
Wilsonia pusilla	Wilson's warbler
Euphagus carolinus	rusty blackbird
Pinicola enucleator	pine grosbeak
Leucosticte arctoa	rosy finch
Carduelis hornemanni	hoary redpoll
Loxia curvirostra	red crossbill
Spizella arborea	American tree sparrow
Zonotrichia atricapilla	golden-crowned sparrow
Zonotrichia leucophrys	white-crowned sparrow
Passerella iliaca	fox sparrow
Melospiza melodia	song sparrow
Melospiza lincolnii	Lincoln's sparrow
Calcarius lapponicus	Lapland longspur
Plectrophenax nivalis	snow bunting

declines are of concern (Klosiewski and Laing 1994). During field surveys, one female harlequin was observed and suspected of nesting on the lower reaches of Meadow Creek in the RNA.

The harlequin duck is listed by the U.S. Fish and Wildlife Service as a “species of concern” and identified as an "injured species" as a result of the 1989 Exxon Valdes oil spill in Prince William Sound. Research indicates several population concerns: 1) reduced densities of birds in the breeding season, 2) a declining trend in the summer, post-breeding population, and very poor production of young in western Prince William Sound (Exxon Valdez Oil Spill Trustee Council 1994). Watershed stability in the area of breeding is an important nesting habitat requirement.

The harlequin is a seaduck and, during the winter, resides in close association with nearshore marine waters. Associated with turbulent and rocky coastline, they rest on exposed rocks, ledges, and islets and feed among kelp and mussel beds (Campbell et. al 1990). However, in preparation for breeding, harlequin pairs move to freshwater as early as April. They select nest sites along clear, fast-moving streams with shelter and plentiful aquatic food. Freshwater foods may include insects (e.g., stone flies, midges, boatmen), fishes (e.g., salmon fry), fish eggs, and miscellaneous items (e.g., spiders, worms). Having high nest site fidelity, harlequins return to the same area of the same stream in successive years. Preferred nest habitat is characterized by protected stream recesses, cavities, shrubs, or downed trees within 6.6 feet (2 m; though occasionally up to 65 feet (20 m)) from the stream. They are solitary nesters and late season breeders (Palmer 1976).

Amphibians and Reptiles

The wood frog, *Rana sylvatica*, was the only amphibian seen in the Kenai Lake-Black Mountain RNA. It was observed in an open area within the spruce-hemlock forest. The only other species that may be present, though uncommon, are the western toad, *Bufo boreas* and the, even more rare, rough-skinned newt, *Taricha granulosa* (USDA Forest Service 1982). No reptiles were observed in the RNA and none are predicted to occur there.

Fish

The freshwater fishes that reside in the ponds and stream systems of the Kenai Lake-Black Mountain RNA are not well documented. There have been no surveys or sampling in the Black Mountain or Meadow Creek systems by the Alaska Department of Fish and Game or USDA Forest Service. During years of high salmon returns, it is possible that Meadow Creek may be used as spawning habitat by *Onchorynchus* spp. (Ted Spraker, Alaska Department of Fish and Game, *personal communication*).

Based on suspected general distributions of freshwater species, there are a number of potential residents, including Dolly varden (*Salvelinus malma*), three-spined sticklebacks *(Gasterosteus aculeatus*), and cutthroat trout (*Salmo clarki*). Based on Morrow (1980), the following families may be represented in the RNA:

Lampreys - Petromyzontidae
Salmon and trout - Salmonidae
Whitefish - Salmonidae
Stickleback - Gasterosteidae
Sculpin - Cottidae

Insects

The spruce bark beetle is the most significant natural mortality agent of mature spruce in North America. In the past several decades, a bark beetle outbreak has caused over 2 billion board feet (850,000 cubic meters) of lost tree volume in Alaska. During this process, extensive tree mortality has resulted in changes in forest structure as stand density decreases and larger trees (diameter greater than 18 inches) are replaced by smaller ones. During the process, natural community composition is altered and there may be, for example, an associated increase in the number of woodpeckers and other avian species. While endemic populations live in downed trees (e.g., windthrow, slash), beetle numbers have increased to levels where they successfully infest large-diameter, mature trees (Holsten et. al 1991).

On the Kenai Peninsula, white spruce and Lutz spruce have been heavily attacked. In the Kenai Lake-Black Mountain RNA, about 64% (ca. 1640 acres, 665 hectares) of the forest acreage has been infested by spruce bark beetles for three or more years over the 1978 through 1999 period (Figure 5). Within these infestations, mature spruce mortality was up to 90 percent in sample plots used in the development of this establishment record.

Table 9 is a list of all freshwater invertebrate species that were observed in the RNA during the field survey for developing this establishment record. Specimens were taken from the lower reach of Meadow Creek and the middle reach of the east fork of Meadow Creek. Elaine Major at the Environment and Natural Resources Institute at the University of Alaska Anchorage identified them in the laboratory.

Geology

The Kenai Lake-Black Mountain RNA is made up entirely of the Upper Cretaceous Valdez Group rocks (Tysdal and Case 1979). These

Table 9 – Freshwater invertebrate species observed in Kenai Lake-Black Mountain RNA[15].

Order	Family	Genus
Ephemeroptera	Siphlonuridae	*Ameletus*
	Baetidae	*Baetis*
	Heptageniidae	*Cinygmula*
		Epeorus
	Ephemerellidae	*Drunella*
Plecoptera	Nemouridae	*Zapada*
	Chloroperlidae	*Plumiperla*
	Capniidae	*Capnia*
	Perlodidae	*Isoperla*
Trichoptera	+	+
	Brachycentridae	*Brachycentrus*
	Rhyacophilidae	*Rhyacophila*
	Limnephilidae	*Onocosmoecus*
		Apatamia
		Imania
Tricladida	+	+
Diptera	Chironomidae	+
	Empididae	+
	Simuliidae	+
Amphipoda	Gammarus	+
Oligochaeata	+	+
Mollusca	+	+

[15] + = family and/or genus were not determined.

sedimentary rocks have been interpreted as turbidities. Turbidities are rocks which were originally deposited by turbidity currents prior to lithification. The unit consists of interbedded metasandstone, metasiltstone, argillite, slate, and phyllite (Nelson et al. 1985).

The area was shaped by Pleistocene glaciation and downcutting streams. Remnant glaciers are still present within the RNA on the northerly slopes of Mount Adair.

Soils

General soil types of the Kenai Lake-Black Mountain RNA are included in Davis et al. (1980). These soils range from those formed in deposits of glacial till over metasedimentary bedrock (as on the slopes of Black Mountain), to alluvial soils along Meadow Creek, and to rock dominated alpine highlands of Sleeping Sister Mountain and Mount Adair.

Topography

The Kenai Lake-Black Mountain RNA is characterized by three distinctive physical settings: 1) the heavily forested slopes of the conical Black Mountain bounded on the north and east by Kenai Lake, and on the south and west by stream drainages; 2) the forest, wetland, and riparian environments along Meadow Creek below 1,200 feet elevation (365 m) in the central portion of the RNA; and 3) the tundra, alpine basins, and remnant glaciers area of the upper portions of Meadow Creek on the south slopes of Sleeping Sister Mountain and north slopes of Mount Adair. The terrain forms are primarily the result of glaciation and stream erosion.

Relief varies from gently sloping terrain in the central portion of the RNA along Meadow Creek, to the 15 - 50% slopes characteristic of Black Mountain, and to very steep slopes characteristic of the north face of Mount Adair (cliff bands also exist on the north slopes of Black Mountain).

Aquatic / Riparian

As shown in the table below summarized from the National Wetlands Inventory[16], 99% of the Kenai Lake-Black Mountain RNA is non-wetland, upland systems:

Wetland System	Acres	Hectares	Percent
Lacustrine	1	1	0
Palustrine	84	34	1
Upland	5744	2324	99
TOTAL	5829	2359	100

[16] The “USF&WS National Wetlands Inventory” data theme of the Chugach National Forest GIS.

Rare, Threatened, Endangered or Sensitive Species

No endangered, threatened, or sensitive species are known to occur within the Kenai Lake-Black Mountain RNA. Trumpeter swan, an Alaska Region sensitive animal species[17], may occur in the RNA based on the known distribution of the species.

The Alaska Region sensitive plant species (Stensvold 2005) listed in Table 10 potentially occur within the RNA based on the presence of favorable habitat. However, their presence has not yet been verified.

Rare Elements & Rare Plant Communities

No rare elements and rare plant communities are known to occur within the Kenai Lake-Black Mountain RNA.

Resource Information

Minerals

There are no known mineral values within Kenai Lake-Black Mountain RNA and no present or historic mining activity. Based on information in Nelson et al. (1984) the area is most favorable for placer gold and moderately favorable for lode gold. Favorable areas are defined largely by the comparison of the geologic environment in the area in question with available geologic, geochemical, and geophysical criteria from areas of known deposits.

The Final Environmental Impact Statement (FEIS) for the Forest Plan (USDA Forest Service 2002c) states that oil and gas leasing is unavailable in the RNA and further notes that none of the areas designated as RNA (including Kenai Lake-Black Mountain) are within areas that have been identified as having potential for oil and gas development. Similarly, the FEIS and the Forest Plan (USDA Forest Service 2002c and 2002b, respectively) state that extraction of salable minerals (sand, gravel, hard rock for crushing, and landscape materials) will not be allowed in RNAs.

Grazing

No domestic livestock are on Kenai Lake-Black Mountain RNA and there is no history of grazing by livestock. Grazing by domestic stock will be prohibited.

Plants

Because of its status as RNA, commercial and personal use timber harvest in the area is not allowed under the Forest Plan (USDA Forest Service 2002b). The FEIS for the Forest Plan (USDA Forest Service 2002c) lists 660 acres of tentatively suitable timberlands in the area.

[17] The Alaska region sensitive species lists are posted at the following USDA Forest Service intranet site: http://fsweb.r10.fs.fed.us/staffs/wfew/wfew_documents/sensitive_species_list.doc

Table 10 – Sensitive plant species potentially occurring in Kenai Lake-Black Mountain RNA[18].

Scientific Name	Common Name	Habitats
Aphragmus eschscholtzianus	Esc. little nightmare	A
Arnica lessingii ssp. *norbergii*	Norberg arnica	AFMT
Carex enanderi	goose-grass sedge	AW
Draba kananaskis	tundra whitlow-grass	A
Isoetes truncate	truncate quillwort	S
Ligusticum caldera	Calder lovage	AFM
Papaver alboroseum	pale poppy	AM
Romanzoffia unalaschcensis	Unalaska mist-made	FRW
Stellaria ruscifolia ssp. *aleutica*	circumpolar starwort	ARW

[18] Nomenclature follows Hulten (1968) except for *Draba kananaskis* and *Ligusticum calderi*, which follow Mulligan (1970) and Calder and Taylor (1968), respectively. Common names follow Stensvold (1994). Habitats are generalized from Stensvold (1994) as follows:

A = alpine and subalpine
F = forests (or forest edge)
T = tall shrubland
M = meadows
R = rock outcrops
W = marshy areas (or streamsides)
S = shallow freshwater.

Much of the tentatively suitable land includes areas where a large portion of the spruce (*Picea*) biomass has been killed by bark beetles (primarily *Dendroctonus rufipennis*).

Watershed Values
All surface waters from the Kenai Lake-Black Mountain RNA flow directly into Kenai Lake. About 80 percent of the RNA lies within the Meadow Creek watershed, and the rest is composed of small, steep, first order drainages flowing directly off Black Mountain into Kenai Lake. The RNA contains essentially no sport fish habitat. Meadow Creek does offer some spawning potential in its lower reaches. Hydropower development potential is very limited. The primary watershed value of the RNA is its contribution of high quality runoff to Kenai Lake and the Kenai River. Establishment of the RNA at this location will not conflict with watershed values or uses. Establishment of the RNA would maintain current water quality and flow.

Recreation Use
Kenai Lake-Black Mountain RNA supports a variety of high-quality scenic and recreational resources provided by the rugged peaks of Mount Adair and Sleeping Sister Mountain, the varied forests of Black Mountain, and the blue waters of Kenai Lake. An area just outside the RNA boundary where Meadow Creek enters Kenai Lake is used occasionally as a recreational campsite and picnic site. Sport hunting and fishing are not restricted in the RNA. The potential for human induced impacts within the RNA is likely minimal given the difficult access, absence of trails, rugged terrain, and thick forest and scrub vegetation.

Under the Forest Plan (USDA Forest Service 2002b) no recreational developments will be constructed within the RNA nor will motorized recreational use be allowed. As stated in the FEIS for the Forest Plan (USDA Forest Service 2002c), existing nonmotorized use will be allowed as long as the use does not degrade RNA values.

Wildlife
The Kenai Lake-Black Mountain RNA features a diversity of wildlife and plant species/communities. Establishment of RNA will in no way adversely affect wildlife and plant values in the area. RNA designation will be beneficial in protecting wildlife and floristic values.

As stated in the FEIS for the Forest Plan (USDA Forest Service 2002c), habitat manipulation for wildlife is not allowed unless specifically needed to restore natural ecosystem conditions or specifically designed for the protection of threatened, endangered, or sensitive species. Such manipulations are not presently called for or anticipated in the RNA.

Transportation / Road System
The Forest Plan (USDA Forest Service 2002b) does not allow new Forest Service roads to be built in RNAs and new trail construction is prohibited (unless

the new trail contributes to the objectives or to the protection of the RNA). There are no plans for road or trail construction within the Kenai Lake-Black Mountain RNA. Establishment of the RNA would not affect any existing or proposed road access system on the Chugach National Forest.

Historical Information

Research / Education Use & Interest

Except for mountain goat population estimation in the Mount Adair area (see fauna values section above) there is no known historical use of the Kenai Lake-Black Mountain RNA for research or education.

Cultural / Heritage

There are no Native inholdings or allotments in the Kenai Lake-Black Mountain RNA. The RNA has not received an archeological survey and there are no known sites of cultural or historic significance within the RNA.

Little information is available on ancient native inhabitants of Kenai Lake-Black Mountain RNA. However, evidence of ancient inhabitants dating back 7,000 to 10,000 years has been discovered in other areas near Kenai Lake (Reger 1998; Yarborough 1983).

Disturbance History

The primary natural disturbances affecting the Kenai Lake-Black Mountain RNA are spruce bark beetle infestations (Holsten et al. 1995) that have likely caused the most significant alterations to forest structure and composition within the RNA over the last 200+ years, fire at a return interval that likely exceeds 500 years (Potkin 1997), snow avalanches, and landslides.

Primary human uses of the area has been selective tree harvesting (mostly in the early 1900's) on the lower slopes of Black Mountain and hunting and camping primarily along the Meadow Creek drainage.

Occurrence of Exotic Species

Existing surveys on the Chugach National Forest (DeVelice et al. 1999; DeVelice 2003; Duffy 2003) found that most areas of exotic plant occurrence on the Forest are presently in areas of intensive human-caused disturbance such as road edges, visitor facilities, trailheads, and trails. Exotic plants are presently rare within natural communities on the Forest.

No exotic plant records were found within the Kenai Lake-Black Mountain RNA in a query of the Alaska Exotic Plant Information Clearinghouse database (AKEPIC[19]). In addition, no exotic plants were recorded during field surveys of the area in the development of this establishment record. It is likely that

[19] http://akweeds.uaa.alaska.edu/

scattered populations of exotics are present but the extent and number of individuals is likely small.

Other Information

Permanent Research Plots and/or Photo Points

Since 1993, the Chugach National Forest Ecology Program has established a network of 27 forest monitoring plots on the Kenai Peninsula. The purpose of these plots is to quantify overstory and undergrowth vegetation compositional changes, with emphasis on Lutz spruce forests affected by the spruce bark beetle. Two of these permanent plots lie within the Kenai Lake-Black Mountain RNA.

Potential Research Topics

The Kenai Lake-Black Mountain RNA provides opportunities for the study of both short- and long-term ecological change (such as forest successional responses following bark beetle induced tree mortality). The RNA also provides a reference area for determining the effects of resource management activities applied to similar ecosystems outside the RNA. The wide spectrum of biophysical conditions represented, including a gradient of hybridization between Sitka and white spruce, provide opportunities for the characterization of biodiversity patterns in relation to environmental drivers.

Evaluation of Specific Management Recommendations

Potential or Existing Conflicts

See the “Resource Information” section above for a summary of potential and existing conflicts. In summary, there are no known conflicting uses within the Kenai Lake-Black Mountain RNA for minerals, grazing, commercial or personal timber harvest, watershed values, recreation use, wildlife and floristic values, and transportation systems.

Special Management Area

The Kenai Lake-Black Mountain RNA does not lie within or adjacent to any congressionally designated wilderness, wild and scenic river, or national recreation area.

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APPENDIX

Management Area Prescription

The following text is from the Revised Land and Resource Management Plan of the Chugach National Forest (USDA Forest Service 2002b) and summarizes the management area prescription for Research Natural Areas:

141 - Research Natural Area Management Area – Category 1

Theme - Research Natural Areas (RNAs) emphasize non-manipulative research, monitoring, education, and the maintenance of natural diversity, allowing natural physical and biological processes to prevail without human intervention. RNAs serve as baseline reference areas for measuring long-term ecological change. This management area prescription specifies management area direction for designated Research Natural Areas.

Management Intent

Ecological Systems Desired Condition - RNAs are characterized by essentially unaffected environments in which natural ecological processes dominate, largely undisturbed by human activity. Management activities on other lands are compared to the RNA to measure the effectiveness of various standards, guidelines and mitigation measures in reducing or preventing adverse environmental effects. Specific management direction, consistent with the purpose, will be developed for each RNA as it is established.

Social Systems Desired Condition – Management for recreation uses, habitat improvement or restoration and resource development are not emphasized. Recreation uses that interfere with the purpose of the RNA may be restricted. RNAs will provide outstanding opportunities for research, study, observation, monitoring, and those educational activities that maintain unmodified conditions. The Recreation Opportunity Spectrum will range from Primitive to Semi-primitive Nonmotorized. While a pristine condition is the goal in the selection of an RNA, there may be some evidence of past human use in this area, such as primitive trails or historic structures. Heritage resources will remain in an undisturbed state, with data recordation as the preferred method to mitigate the loss of heritage resources. Cabins and other historic, aboveground features will be present in their natural state, with no on-site interpretation.

There will be no roads, trails, fences, or signs in these areas unless they contribute to the RNA objectives or the protection of the area. Mining activities may occur on existing claims. In order to implement this prescription as intended, the Forest Service may request that the Bureau of Land Management withdraw areas, subject to the establishment of valid existing rights, within this management area prescription from location and entry under the United States mining laws.

Research Natural Area Management Area - Activities Table

Physical Elements			
Soil/Watershed Projects	C		
Biological Elements			
Vegetation Management	N	Integrated Pest Management	C
Wildlife Habitat Projects	C	Management Ignited Prescribed Fire	C
Fish Habitat Projects	C		
Resource Production			
Forest Products		**Minerals/ Mining**	
Commercial Timber Harvest ASQ	N	Mineral Activities – Locatable	C
Commercial Timber Harvest - nonchargeable	N	Mineral Activities – Salable	N
Commercial Special Forest Products	N		
Personal Use Timber Harvest	N		
Personal Use Special Forest Products	N		
Use and Occupancy Activities			
Recreation/Tourism Activities			
Recreational Gold Panning	N	Forest Service Recreational Cabins	N
Maximum ROS Class [1]	SPNM	Campgrounds	N
Nonmotorized Recreation Use - Summer	C	Minimum SIO [2]	VH
Nonmotorized Recreation Use - Winter	C	Hardened Dispersed Camping Sites	N
Day-use Facilities	N	Viewing Sites	N
Transportation/Access			
Marine Transfer Facilities	N	New Roads Built by Others	C
Boat Docks and Ramps	N	New Trails	C
Mode Changes: Parking Lots at Trailheads, Ferry Terminals, etc.	N	Administrative and Permitted Motorized Access	C
New FS Built Roads	N		
Lands/Special Uses			
Electronic Sites	N	SUP Recreation Equipment Storage/Cache	N
Utility Systems	N	Outfitter/Guide Capacity Allocation (%)	NA
SUP Destination Lodges	N	Administrative Facilities	C
SUP "Hut-to-Hut" Type Recreation Cabins	N		

Y - the activity is allowed consistent with the management intent

C - the activity is allowed consistent with the management intent, standards and guidelines

N - the activity is not allowed in the management area

N/A - not applicable

[1] ROS (Recreation Opportunity Spectrum) classes: P - Primitive I and II; SPNM - Semi-primitive Nonmotorized; SPG - Semi-primitive Groups; SPM - Semi-primitive Motorized; RN - Roaded Natural; RM - Roaded Modified; R - Rural

[2] SIO (Scenic Integrity Objective) classes: VH - Very High; H - High; M - Moderate; L - Low; VL - Very Low

Standards and Guidelines

Soil/Watershed – Fisheries – Wildlife

Standards	1.	Allow soil/watershed restoration projects and wildlife and fish habitat manipulation for the protection of threatened, endangered or sensitive species or where it is necessary to perpetuate or restore natural conditions for which the RNA was established.

Integrated Pest Management

Guidelines	1.	Treatment measures may be taken on exotic plants and animals to minimize their impacts on ecological processes.

Fire and Fuels

Standards	1.	Allow natural fires to burn to accomplish the objectives of the specific research natural area.
	2.	Use management prescribed fire as necessary to accomplish RNA objectives.

Minerals

Guidelines	1.	RNAs may be withdrawn, subject to the establishment of valid existing rights, from mineral entry for locatable minerals.
	2.	Mineral activities may be limited, modified or restricted to maintain, to the extent possible, the natural values of the area.

Recreation

Standards	1.	Allow non-vehicular recreation, except when it interferes with the purpose of the RNA.

Access and Transportation

Standards	1.	Prohibit the construction of new trails unless they contribute to the objectives or to the protection of the RNA.
Guidelines	1.	Close or obliterate existing roads, except where they provide necessary access for scientific or educational purposes.
	2.	Existing trails may remain unless they are not consistent with the purpose of the RNA.
	3.	Administrative and non-recreational motorized access (e.g., helicopter landings) may be allowed if such activities do not interfere with the objectives for which the RNA was established.

Access and Transportation (Continued)

Guidelines

4. If no other reasonable access exists, provide such access, including roads for conducting mineral operations under a mining plan of operations. Aircraft access is allowed for minerals exploration and will be coordinated with the responsible line officer to minimize impacts to the natural character of the area.
5. If no other reasonable access exists elsewhere, provide reasonable access to private lands.

Special Uses (Recreation)

Standards

1. No competitive group events are allowed.

Administrative Facilities

Standards

1. Administrative facilities are not allowed. Temporary facilities may be permitted to support approved research projects.

FIGURES

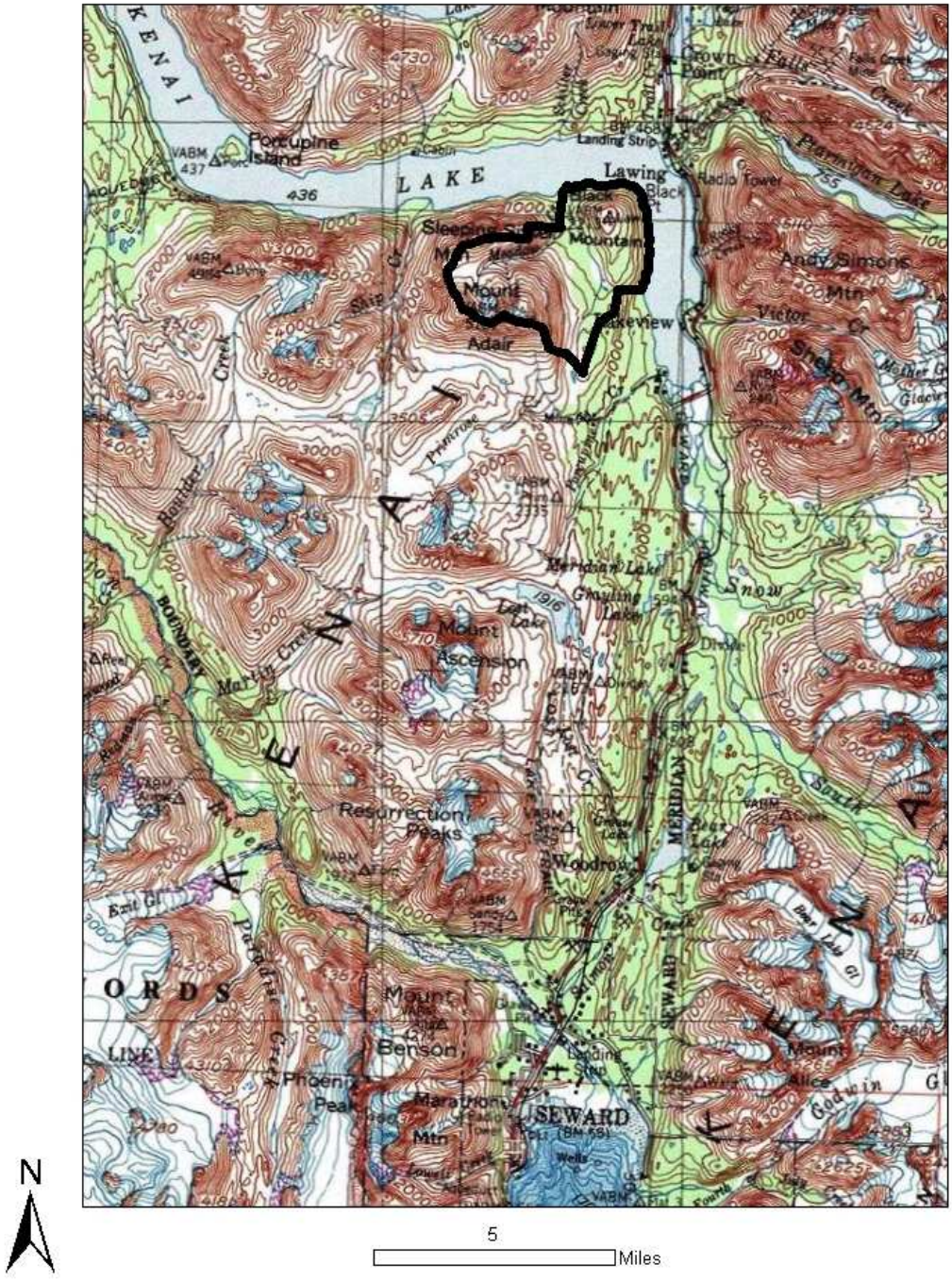

Figure 1 – Location of Kenai Lake-Black Mountain RNA north of the city of Seward, Alaska.

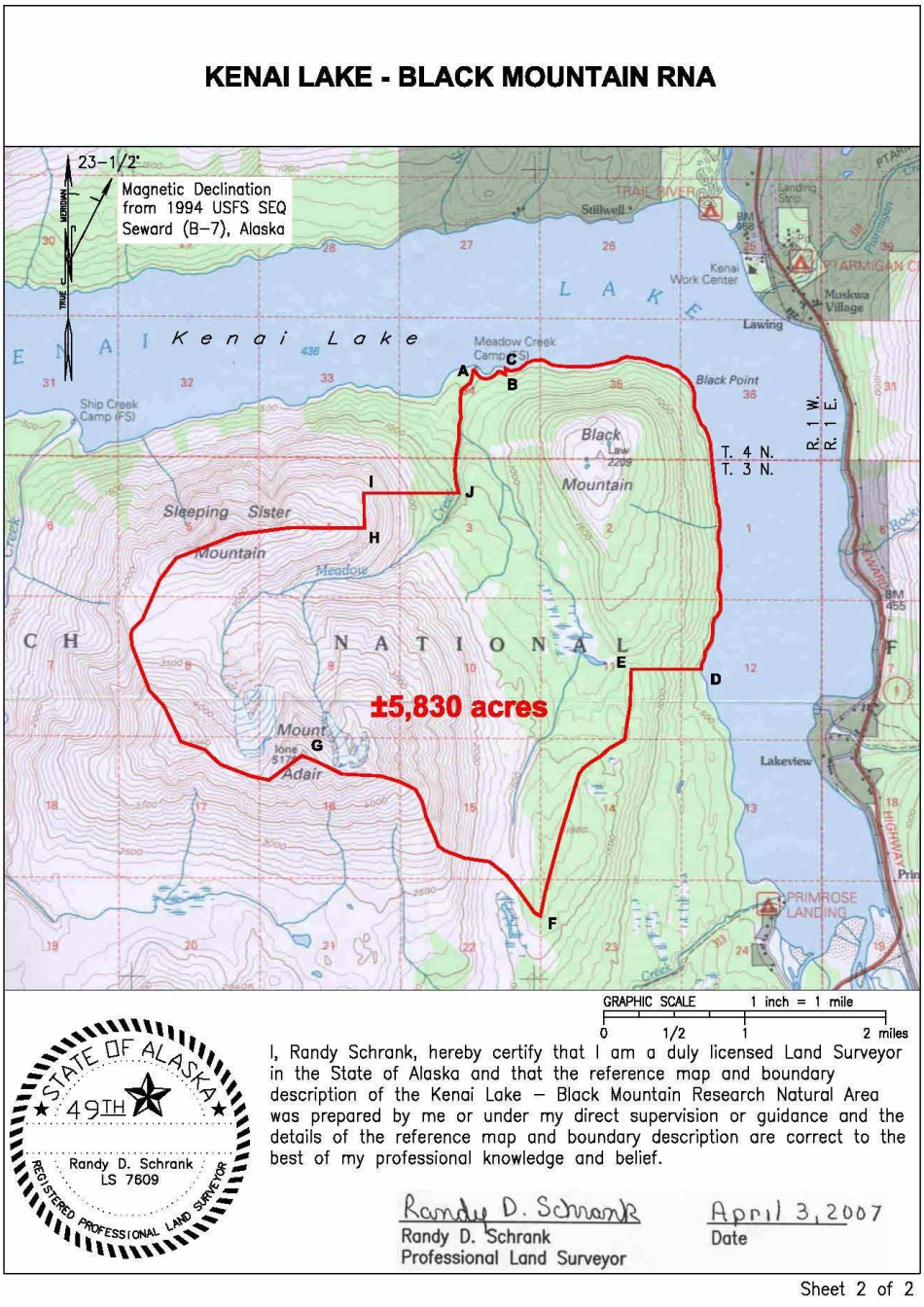

Figure 2 – Location of Kenai Lake-Black Mountain RNA within the public land survey system (with certification by licensed land surveyor).

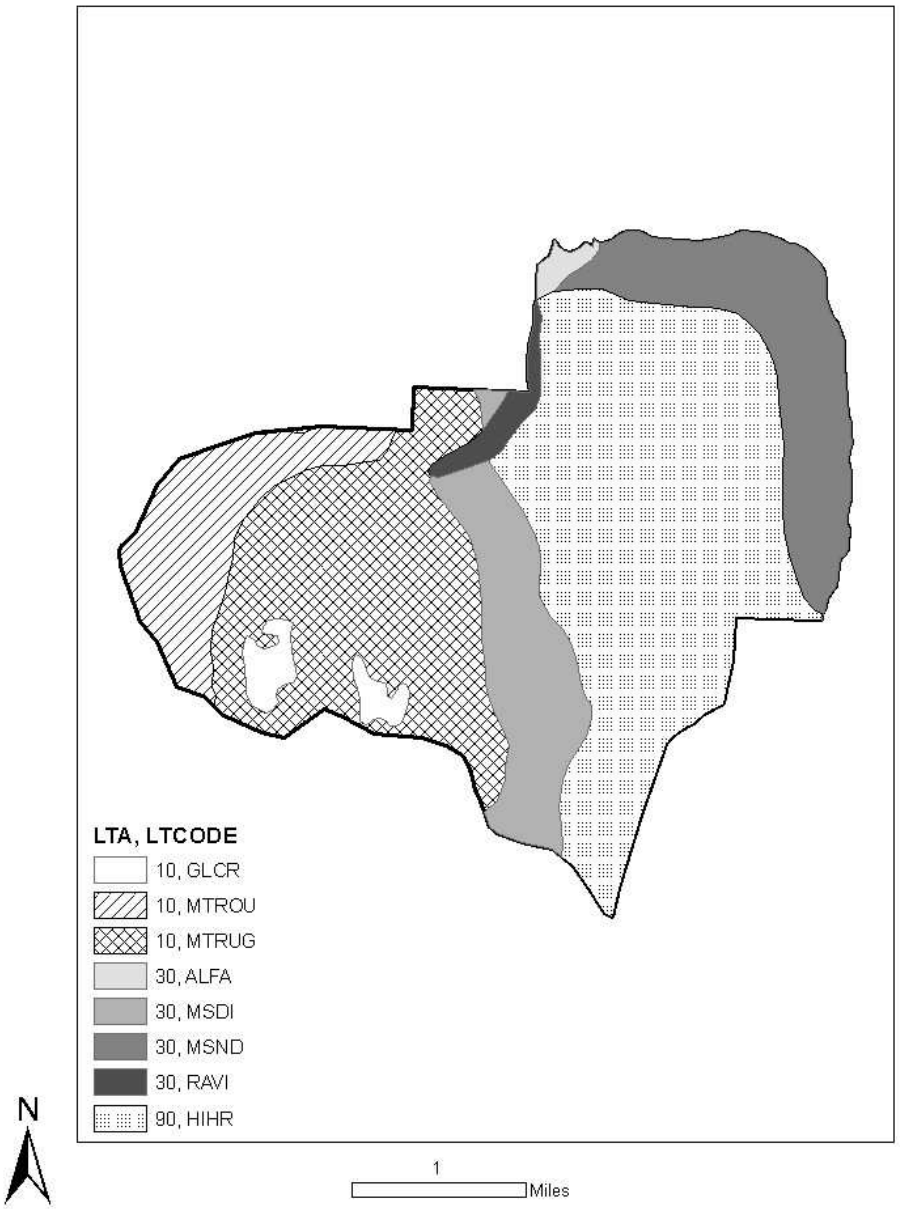

Figure 3 – Landtype associations and landtypes of Kenai Lake-Black Mountain RNA[20].

[20] Data from the "Landsystem Types" data theme of the Chugach National Forest GIS. Landtype Association 10 = mountain summits; 30 = mountain sideslopes; and 90 = hills. Landtype ALFA = alluvial vans; GLCR = glacier; HIHR = hills - high relief; MSDI = mountain sideslopes - disturbed; MSND = mountain sideslopes - non disturbed; MTROU = mountains - rounded; MTRUG = mountains - rugged; and RAVI = ravines.

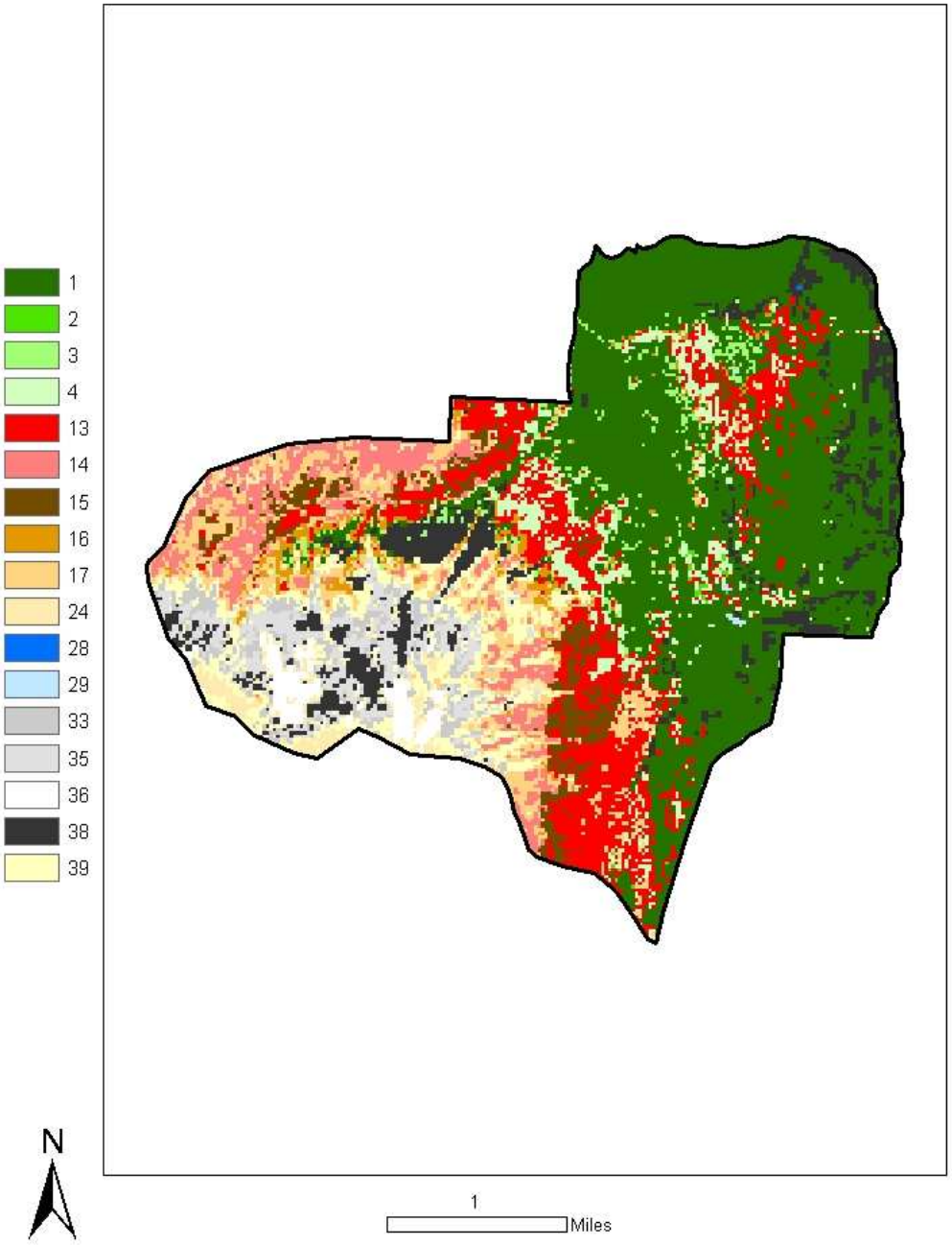

Figure 4 – Landcover classes of Kenai Lake-Black Mountain RNA[21]. See Table 3 for the description of cover class values.

[21] Data from the "Land Cover Classification" data theme of the Chugach National Forest GIS.

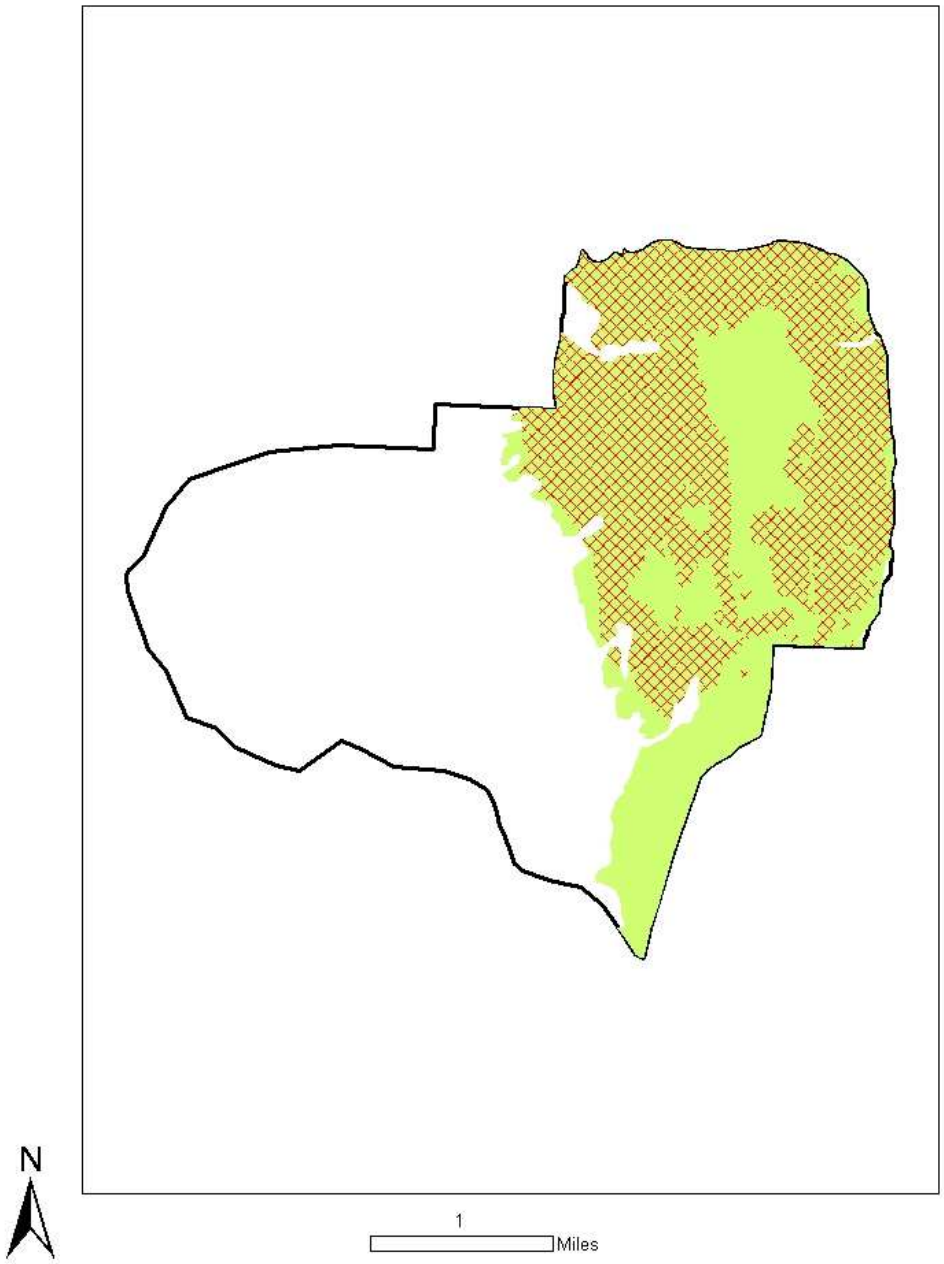

Figure 5 – Spruce bark beetle infestation area within forests of the Kenai Lake-Black Mountain RNA[22]. The cross-hatched area has been infested on three or more years between 1978 and 1999.

[22] Data from the "Insect Infestation" data theme of the Chugach National Forest GIS.

PHOTOGRAPHS[23]

Photo 1 – Black Mountain, Mount Adair, and Sleeping Sister Mountain (left to right) as viewed from the shores of Kenai Lake at Kenai Lake Work Center.

Photo 2 – Remnant glacier on the north slopes of Mount Adair.

[23] These digital images are all archived with the Forest Ecologist, USDA Forest Service, Chugach National Forest, Anchorage, Alaska.

Photo 3 – Along the ridge of Sleeping Sister Mountain looking towards Black Mountain and Kenai Lake (note diversity of tundra vegetation in relation to microtopography).

Photo 4 – Pond and mountain hemlock forest on the summit of Black Mountain.